2. Standard Reports

2.1 General

For consistency and ease of enforcement, the manner in which building features are reported by ACMs is standardized. This section of the ACM Approval manual describes the required standard reports. All residential ACMs shall automatically produce compliance reports as specified in this Chapter. These *Standard Reports* are required to enable building officials to evaluate the results from ACMs without having to learn each computer program. Included in every compliance package will be reports CF-1R and other related forms, which are described in detail below.

The CF-1R shall have two highly visible sections, one for *Special Features and Modeling Assumptions* and a second for features requiring *Field Verification and Diagnostic Testing*. These two sections serve as "punchlists" during compliance verification by the local building department. Items listed in the *Special Features and Modeling Assumptions* section indicate the use for compliance of unusual features or assumptions, and call for special care by the local building department. Items listed in the *Field Verification and Diagnostic Testing* section are for features that require diagnostic testing or independent verification to insure proper field installation in addition to local building department inspection.

Only user inputs are described and included in the standard reports. The fixed and restricted inputs are not included in the standard reports since ACMs shall be designed so that the fixed and restricted inputs and default values in the absence of specific user input are automatically used when the program is used for compliance.

The structure and organization of the Standard Reports described in the subsequent sections should be followed as closely as possible. The reports are divided into tabular listings that have a title, column headings and data entries. The data entries shown in the listings that appear in this manual are typical values and are included only to illustrate the report format; they are not default values and cannot be assumed to be in compliance with the standards. The specification of the category or type of data expected in each field is provided in the list of definitions associated with each column heading. The type of data entries will be one of the following:

- Text: A variable-length text field input by the user.
- Recommended Descriptor: An abbreviation or short name from lists or tables of permissible types provided within this manual (e.g., LgStoGas). Only types found in these lists or tables may be used. Different descriptors may be used by the ACM as long as they are reasonable descriptors for the list entry item and are not misleading. In some cases where the descriptor is a short complete word, the descriptors are prescribed and shall be used. Even for prescribed descriptors some discretion is allowed. For example, for tables with long rows Y may be used for the prescribed descriptor Yes. User-defined descriptors may NOT be used but rather shall be automatically assigned by the ACM based upon user input. For example, UWALL01 may be assigned by the ACM to the first user-defined wall type.
- Filename.ext: The name of the input or output file
- Dimensions or units of measure, such as "hr-ft²-°F /Btu", ft², etc.
- Num: A cardinal or ordinal number.

Deviations from the standard reports will be approved by the Commission on a case-by-case basis when they are necessary because of conceptual differences between ACMs or because of special modeling features. The categories of information represented in the tables and the standard headings shall not be changed. Additional columns or additional tables may be added when necessary and column headings may be abbreviated, and reports may be reformatted with different character spacing, line spacing, row heights or column widths to permit better readability or paper conservation. ACMs may also provide additional customized information at the bottom of the standard reports, separated from the standard report by a line.

Some of the tables in the standard reports are not applicable for all buildings. When a table is not applicable for a particular building, it should be omitted. When one of the standard tables is included, all the columns should be included (although column width may be reduced), even if some of the information in the columns is not applicable to the proposed design.

The Standard Reports are designed to accommodate the optional modeling capabilities included in this manual. Approval of additional optional modeling capabilities may require modification of the standard report format.

2.2 Certificate of Compliance –Residential Computer Method (CF-1R)

The Certificate of Compliance (report CF-1R) is the principal standard report that shall be produced. The Certificate of Compliance is required by the Administrative Requirements (Title 24, Section 10-103).

The CF-1R (Residential Computer Method) shall include all information provided by the program user. If the standard report does not fully document all user inputs, additional tables or notes shall be added by the program vendor to fully document all user inputs.

Information on the Certificate of Compliance is provided below to illustrate the use of all the standard tables.

2.2.1 Report Headings

The following heading shall appear on the first page.

CERTIFICATE OF COMPLIANCE: Page 1 of 4
RESIDENTIAL COMPUTER METHOD

Project Title	Filename:	Date:
Project Address	Run Title:	<runcode>
Documentation Author		<initiation time>
Telephone		Building Permit #
Compliance Method		Plan Check / Date
Location/Climate Zone		Field Check/ Date

The Filename, Run Title, Runcode, and Initiation Time need not appear in the header as shown above but shall appear as part of the header information for all pages of the Certificate of Compliance.

The following heading shall appear on subsequent pages.

CERTIFICATE OF COMPLIANCE: Page 2 of 4
RESIDENTIAL COMPUTER PERFORMANCE

Project Title	Filename:	Date:
	Run Title:	<runcode/initiation time>

- *Project Title, Date, Project Address, Documentation Author and Telephone, and Climate Zone (text):* Display user inputs for these fields.
- *Filename (filename.ext):* The filename of the input file used to generate the compliance form.
- *Compliance Method (te*xt): The Alternative Calculation Method program name and version number.
- *<Runcode/Initiation Time> (alphanumeric text):* A unique runcode designation generated automatically by the ACM to identify the specific run. This number and the initiation time changes with each run initiated by the user even though the filename and Run Title may remain the same. The initiation time is the time (including the hour and minute) that the compliance run was initiated by the user.
- *Run Title (text):* Optional user input item. Use for commentary or description of unique characteristics of a particular run.

2.2.2 Energy Use Summary

This section compares the energy use of the proposed building to the energy budget of the standard design building. All units in this table are TDV (time dependent valuation) energy (kBtu/ft^2-yr). Energy is shown for space heating, space cooling and hot water. The space heating and cooling energy budgets are determined from the standard design using the custom budget method. The water heating budget is calculated from the custom budget water heating calculation methods described in this document. ACM vendors may add additional columns or rows to this report when appropriate, such as for multi-zone building analyses or breaking out energy use components such as HVAC fans.

TDV ENERGY USE SUMMARY (kBtu/ft^2-yr)

	Standard Design Energy Budget	Proposed Design Energy Use
Space Heating	23.45	21.23
Space Cooling	10.34	8.23
Water Heating	15.90	14.67
Total	49.69	44.13

Additional rows may be added to the table when necessary to accommodate energy uses that are to be included in the analysis but cannot be easily assigned to one of the three principal categories. Examples of possible additional rows might include separating fan energy (typically included with cooling) or recirculating pump energy.

2.2.3 General Information

This listing in the Certificate of Compliance follows the first page heading and provides basic information about the building. A description of these data elements is given later in this chapter.

GENERAL INFORMATION

HERS Field Verification/Diagnostic Testing Required for Compliance	Yes
Conditioned Floor Area:	1384 ft^2
Average Ceiling Height	10.2 ft.
Building Type:	Single Family
Building Front Orientation:	15 deg (North)
Glazing Area as % of Floor Area	14.4%
Average Fenestration U-factor	0.52
Average Fenestration SHGC	0.60
Number of Dwelling Units:	1
Number of Stories:	2
Floor Construction Type:	Slab on grade
Number of Conditioned Zones:	2
Total Conditioned Volume:	11072 cf
Conditioned Slab Floor Area:	1384 ft^2
Total Conditioned Floor Area:	1384 ft^2

- *HERS Field Verification/Diagnostic Testing Required For Compliance (yes or no).* At the very beginning of the Certificate of Compliance, this provides a prominent notification when compliance with the performance standards requires HERS Rater field verification or diagnostic testing.
- *Conditioned Floor Area.* The conditioned floor area of all building zones modeled in the computer run.
- *Building Type.* The type of building. Possible types are single-family and multi-family.
- *Construction Type.* The type of construction. Possible types are new, existing, addition alone and existing plus addition plus alteration.
- *Building Front Orientation.* The azimuth of the front of the building. This will generally be the side of the building where the front door is located. A typical reported value would be "290° (west)". This would indicate that the front of the building faces north 70° west in surveyors terms. The closest orientation on 45° compass points should be verbally reported in parenthesis, e.g. north, northeast, east, southeast, south, southwest, west or northwest. When compliance is shown for multiple orientations, "all orientations" may be reported. When "all orientations" is reported it shall be included in the *Special Features and Modeling Assumptions* listing.
- *Number of Dwelling Units.* The total number of dwelling units in the building. This number may be a fraction for cases of addition alone.
- *Number of Stories*. The number of building stories as defined by the *California Building Code*.
- *Floor Construction Type.* The ground floor construction type is one of the factors considered when determining the amount of thermal mass in the *Standard Design*.
- *Number of Conditioned Zones.* The number of conditioned zones modeled in the computer run.
- *Total Conditioned Volume.* The total volume of conditioned space within the building.

- *Conditioned Slab Floor Area.* The total area of slab floor (on grade or raised) with conditioned space above and the ground or unconditioned space below. This is used to determine the standard design mass requirement for buildings and the default values of the thermal mass requirements for the proposed design.
- *Total Conditioned Floor Area.* The total floor area of conditioned space in the building to be permitted. This area shall be no less than the *Conditioned Slab Floor Area* specified above. The conditioned nonslab floor area is the difference between the *Total Conditioned Floor Area* and the *Conditioned Slab Floor Area* and is used to determine the thermal mass for the Standard Design, the default value of thermal mass for the Standard Design, and the threshold thermal mass requirement for thermal mass credit in the Proposed Design. The conditioned nonslab floor area includes any nonslab floors, raised or not, and raised slab floors with conditioned space above and below the floor.

2.2.4 Building Zone Information

For most compliance documentation, only one row will be reported in this table. Additional rows are reported when a proposed building is modeled as two zones or when attached, unconditioned spaces are modeled, such as crawl spaces or sunspaces.

BUILDING ZONE INFORMATION

Zone Name	Floor Area ft^2)	Volume (ft^3)	# of Units	Zone Type	Tstat Type	Vent Height (ft)	Vent Area (ft^2)
House	1384	11072	1	Conditioned	Setback	2.0	32

- *Zone Name.* Each zone is given a name that is used to categorize information in the following tables.
- *Floor Area (ft^2).* The floor area of the zone measured to outside wall. The sum of the floor area of all conditioned zones shall equal the conditioned floor area reported under "General Information".
- *Volume (ft^3).* The volume of the zone. The sum of the volume of all conditioned zones shall equal the total volume reported under "General Information".
- *# of Units.* The number of dwelling units in the zone. This number may be a fraction for cases of addition alone or a building in which there are more zones than dwellings.
- *Zone Type.* This description controls some modeling restrictions, such as infiltration, internal and solar gains, etc. Possible conditioned zone entries are Conditioned, Living and Sleeping. Possible unconditioned zone entries include Unconditioned, CVCrawl and Sunspace.
- *Thermostat Type*. Possible conditioned zone entries are Setback, NoSetback, LivingStat, SleepingStat. Additional thermostat types may be allowed for optional modeling capabilities.
- *Vent Height (ft)*. The height difference between the "inlet" ventilation area and the "outlet" ventilation area. The default ventilation height is determined by the number of stories: one story - 2 feet, two or more stories - 8 feet. Different vent heights may be modeled but a non-default vent height is considered a special feature or special modeling assumption that shall be reported in the *Special Features and Modeling Assumptions* listing for special verification. The ventilation height for other windows is the average height difference between the centers of the lower operable window openings and the centers of the upper operable window openings.
- *Vent Area (ft^2)*. This entry is either the default vent area which is assumed by the ACM based on entries in the Fenestration Surfaces table or some other value entered by the user. A Vent Area value greater than 10% of the total rough-out opening area (all windows treated as opening type: “slider”) of all fenestration shall be reported in the *Special Features and Modeling Assumptions* listing for special verification.

2.2.5 Opaque Surfaces

A row shall be reported in this table for each unique opaque surface in the proposed building. Opaque surfaces include walls, roofs, and floors. Low-rise residential buildings may have either *Standard* or *Improved* envelope

construction quality. This is a feature at the whole building level and not at the surface or construction type level. Envelope construction quality is reported in the *Field Verification and Diagnostic Testing* section of the CF-1R.

For buildings that are modeled as multiple thermal zones, the opaque surfaces shall be grouped for each zone and indicated with a header "Zone = <ZoneName>". Alternatively, an additional column may be added to the table to indicate the zone the building element is next to. The zone name used in the header should be the same as the name used in the table titled "Building Zone Information".

OPAQUE SURFACES

Surface Type	Area (ft^2)	U-factor	Cavity Insul R-value	Sheath. Insul. R-value	True Azimuth	Tilt	Solar Gains	Appendix IV Reference	Location/ Comments
Zone=Living									
Wall	105.4	0.088	R-13	na	0	90	Yes	IV1-A3	Typical
Wall	145.4	0.068	R-11	R-4	180	90	Yes	IV1-A3	Typical
Base WallA	100	0.124	na	R-6	0	90	No	IV5-E5	0-2 ft below grade
Base Wall B	160	0.124	na	R-6	0	90	No	IV5-E5	2-6 ft. below grade
Wall	176.8	0.088	R-13	na	270	90	Yes	IV1-A3	Typical
Roof	692	0.031	R-30	na	0	0	Yes	IV4-A8	Typical
Zone=Sleep									
Wall	145.4	0.088	R-13	na	0	90	Yes	IV1-A3	Typical
Wall	176.8	0.068	R-11	R-4	90	90	Yes	IV1-A3	Typical
Wall	145.4	0.088	R-13	na	180	90	Yes	IV1-A3	Typical
Roof	692	0.031	R-30	na	0	0	Yes	IV4-A8	Typical
Zone=SunSpc									
Wall	72	0.088	R-13	na	90	90	Yes	IV1-A3	Sunspace Wall
Wall	90	0.088	R-13	na	180	90	Yes	IV1-A3	Sunspace Wall
Wall	72	0.088	R-13	na	270	90	Yes	IV1-A3	Sunspace Wall
Roof	135	0.031	R-30	na	0	0	Yes	IV4-A8	Sunspace Roof

- *Surface Type.* Valid types are Wall, BaseWallA (0-1.99 ft below grade), BaseWallB (2.0-5.99 ft below grade), BaseWallC (more than 6 ft below grade), Roof/Ceiling, and Floor. If floor is over a crawl space (FlrCrawl), then the U-factors used in the custom budget run are based on having a crawl space. Otherwise, they are not. Floor types and areas are also used to determine the default thermal mass for the Proposed Design and the thermal mass for the Standard Design.
- *Area (ft^2).* The area of the surface.
- *Assembly U-factor.* The overall U-factor of the construction assembly selected from ACM Joint Appendix IV. Note that the U-factors reported in this table are the same whether or not construction quality procedures are followed. There is a credit for construction quality, but it is embedded in the software and not reported as adjustment to the U-factor.
- *Cavity Insul R-val.* The rated R-value of the installed insulation in the cavity between framing members. This does not include framing effects or the R-value of drywall, air films, etc. When insulating sheathing is installed over a framed wall, the "Cavity Insul R-val" should report the insulation in the cavity only. This value is not entered by the user, but is determined when the user selects a standard construction from ACM Joint Appendix IV.

- *Sheath Insul R-val.* The sum total rated R-value of all installed layers of insulating sheathing shall be reported. The sum of the R-values is reported for multiple sheathing layers. This value is not entered by the user, but is determined when the user selects a standard construction from ACM Joint Appendix IV.
- *True Azimuth.* The actual azimuth of the surface after adjustments for building rotation. There are various ways of describing the orientation or azimuth of surfaces. For ACMs approved by the CEC, a standard convention shall be used. The azimuth is zero degrees for surfaces that face exactly north. From this reference the azimuth is measured in a clockwise direction. East is 90 degrees, south 180 degrees and west 270 degrees.
- *Tilt.* The tilt of the surface. Vertical walls are 90°; flat roofs are 0°; floors are 180°.
- *Solar Gains.* A yes/no response is given to indicate if a surface receives solar gains. Surfaces that do not receive solar gains may include floors over crawl spaces and walls adjacent to garages. Only a yes/no response is required since the surface absorptance is a fixed input.
- *ACM Joint Appendix IV Reference.* A reference to the construction assembly selected from ACM Joint Appendix IV. This name may also be referenced from the thermal mass table to indicate an exterior mass wall.
- *Location/Comments.* User provided text describing where the surface is located or other relevant information.

2.2.6 Perimeter Losses

This table provides details about components of the building envelope that are modeled as perimeter losses. Typical perimeter losses are slab edge losses, retaining wall losses, and losses from the base of controlled ventilation crawl spaces. A row is provided in the table for each unique perimeter element. Note that a single F-factor is reported for slab edge losses for slab floor interiors that are carpeted or exposed based on a fixed assumption of 20% of the edge adjacent to exposed slab. This assumption shall be used and separate F-factor values for different interior covering conditions may not be reported or modeled by an approved ACM.

For buildings that are modeled as multiple thermal zones, the items shall be grouped for each zone and indicated with a header "Zone = <ZoneName>". Alternatively, an additional column may be added to the table to indicate the zone the building element is next to. The zone name used in the header should be the same as the name used in the table titled "Building Zone Information."

PERIMETER LOSSES

Perimeter Type	Length (ft)	F-Factor	Insul R-val	Insul Depth (in)	Location/Comments
Zone=Living					
SlabEdge	76	0.70	R-5	24	Exposed edge
Zone=Sleep					
SlabEdge	76	0.70	R-5	24	Exposed edge
Zone=SunSpc					
SlabEdge	65	0.73	R-0	na	Exposed edge

- *Perimeter Type.* The perimeter type. Possible types are slab edge, crawl space perimeter, etc. Names may be abbreviated.
- *Length (ft).* The perimeter length in feet.
- *F-Factor.* The perimeter heat loss factor (see Section 3.2.6).
- *Insul R-Val.* The R-value of the installed insulation. "R-0" or "None" should be reported when no insulation is installed.
- *Insul Depth (in).* The depth that the insulation extends below the top surface of the slab in inches.

- *Location/Comments.* User provided information on the location of the perimeter element or other relevant information.

2.2.7 Fenestration and Doors

The term "fenestration" is used to refer to an assembly of components consisting of frame and glass or glazing materials. According to the standards (Section 101), fenestration includes “any transparent or translucent material plus frame, mullions, and dividers, in the envelope of a building.” Fenestration surfaces include windows, skylights and glazing in doors or other transparent or translucent surfaces. Opaque doors are also included in this section since they represent “openings” in the gross wall or roof, just like window or skylights. This listing reports information about each fenestration product or door. One row is to be included in the listing for each unique condition. When compliance is for all orientations, the building facade orientations shall be reported for the case with the “front” facing north or the orientation shall be reported as “*Any*”.

This listing shall include information about each fenestration surface in the proposed building. Fenestration surfaces include windows, skylights and glazing in doors or other transparent or translucent surfaces. One row is included in the listing for each unique fenestration condition. ACMs shall restrict users to select from a limited list of exterior shading devices and their associated solar heat gain coefficients (SHGCs), namely, those devices and SHGCs listed in the table below for exterior shading devices. ACMs shall not allow users to enter custom shading devices nor account for differences in alternative color, density, or light transmission characteristics. ACMs are required to calculate, but not report, $SHGC_{open}$ and $SHGC_{closed}$ using 2005 Standards calculation procedures and assumptions.

For buildings that are modeled as multiple thermal zones, the fenestration surfaces shall be grouped for each zone and indicated with a header "Zone = <Zone Name>". Alternatively, an additional column may be added to the table to indicate the zone the building element is next to. The zone name used in the header should be the same as the name used in the table titled "Building Zone Information"

FENESTRATION AND DOORS

Fenestration #/Type/Orien	Area (ft^2)	U-factor	Fenes.SHGC	True Az	Tilt	Exterior Shade Type /SHGC	Location / Comments
Zone=Living							
1 Wdw Front(N)	70.4	0.65	0.88	0	90		
2 Wdw Left(E)	70.4	0.65	0.88	90	90	WveScrn/ 0.39	
3 Front Door	20						
4.Garage Door	20						
Zone=Sleeping							
4 Wdw Back(S)	70.4	0.65	0.88	180	90		
5 Wdw Right(W)	70.4	0.65	0.88	270	90	LvrScrn/ 0.36	

- *Fenestration #/Type/Orien.* The # is a unique number for each different fenestration surface entry. The type is Wdw (window) Dr (door) or Sky (skylight). The *Orien* (orientation) is the side of the building (front, left, right or back) followed by the nearest 45° compass point in parenthesis (N, NE, etc.). When compliance is for all orientations, only the side of the building may be reported (front, right, etc.)
- *Area (ft^2).* The area of the surface in square feet. This should generally be the rough frame opening.
- *U-factor*. The rated U-factor of the fenestration product, in Btu/h-ft^2-°F.
- *True Azimuth.* The true (or actual) azimuth of the glazed surface after adjustment for building rotation. The convention for describing the azimuth is standardized as discussed above under opaque surfaces.
- *Tilt.* The tilt of the glazed surface. Most windows will have a 90° tilt. Skylights typically have a tilt equal to the corresponding roof surface.

- *Fenestration SHGC:* The solar heat gain coefficient of the fenestration.
- *Exterior Shade Type/SHGC*. The type of exterior shading device and its solar heat gain coefficient from Table R3-7. "*Standard/0.76*" or " " shall appear when no special exterior shading device is included in the building plans. *Standard (partial bugscreen)* shading shall automatically be given for all window area without other forms of exterior shading devices. This shading assumes that a portion of the window area is covered by bugscreens. Other valid exterior shades include louvered screens (*LvrScrn*), woven sunscreen (*WvnScrn*), and Low Sun Angle Sunscreen (*LSASnScrn*). When used for compliance purposes, ACMs shall not allow or accept input for user-defined exterior shades.

2.2.8 Solar Gain Targeting

This table is only used for special cases, such as sunspaces (an optional modeling capability, and hence a Special Feature). Solar gains that enter conditioned spaces shall be targeted to the air, but when glazing surfaces enclose unconditioned spaces, such as sunspaces, the user is allowed to target all but 25% of the solar gains from these surfaces to mass elements located within the unconditioned space. More than one row of targeting data may be included for each glazed surface. Unassigned solar gain is targeted to the air in the unconditioned space. At least 25% of the solar gain from any sunspace fenestration surface shall be targeted to high surface area lightweight mass or the air. At most 60% of the solar gain may be targeted to the slab floor of a sunspace, especially in the summer. An ACM shall automatically enforce these limits and inform the user of any attempt to exceed these limits.

Note that the use of any optional capability such as sunspace modeling shall be reported in the *Special Features and Modeling Assumptions* listings. In addition, solar gain targeting shall be separately reported in the *Special Features and Modeling Assumptions* listings so that the local enforcement agency can verify that these inputs are reasonable.

SOLAR GAIN TARGETING

Fenestration #/Type/Orien	Mass Name	Winter Fraction	Summer Fraction
1 Wdw Front(N)	SSSlb	0.30	0.30

- *Fenestration #/Type/Orien.* The fenestration surface which transmits solar gain to an interior unconditioned space thermal mass. This corresponds to an item in the fenestration surfaces table.
- *Mass Name.* The name of the mass element to which solar gains are directed. The mass name corresponds to an item in the thermal mass table.
- *Winter Fraction.* The fraction of solar gains targeted from the glazing surface to the absorbing thermal mass when the building is in a heating mode.
- *Summer Fraction.* The fraction of solar gains targeted from the glazing surface to the absorbing thermal mass when the building is in a cooling mode.

2.2.9 Overhangs

Overhangs are a minimum ACM capability and are described in this table.

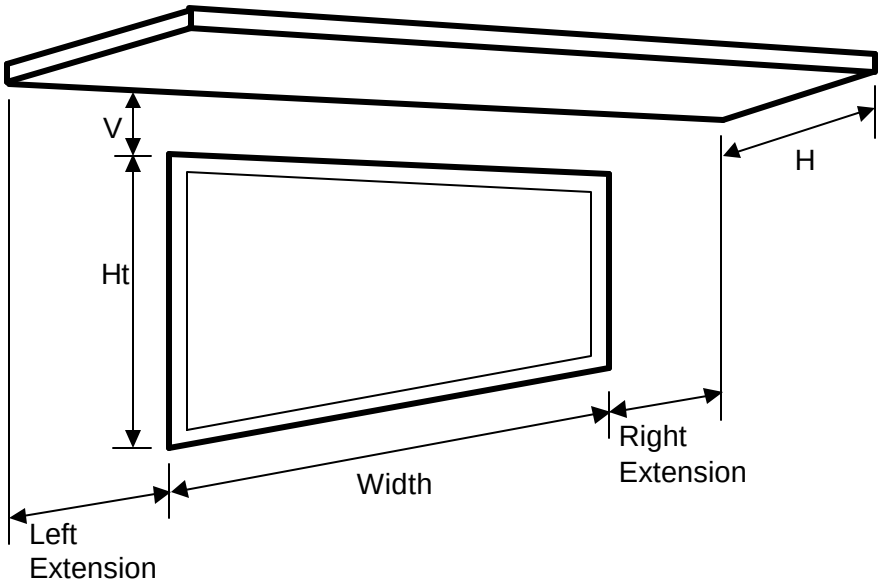

Figure R2-1 – Overhang Dimensions

OVERHANGS

Fenestration			Overhang			
#/Type/Orien	Wdth	Ht	Lngth "H"	Ht "V"	Left Extension	Right Extension
3 Wdw Back(S)	4.0	5.0	2.6	1.5	6.0	6.0

- *Fenestration #/Type/Orien.* This corresponds to an item in the fenestration surfaces list.
- *Fenestration Wdth.* The width of the rough-out frame opening for the fenestration (in feet) measured from the edge of the opening on one side to the edge of the opening on the other side.
- *Fenestration Ht.* The height of the rough-out frame opening for the fenestration (in feet) measured from the bottom of the opening or frame to the top of the opening or frame.
- *Overhang Lngth "H".* The horizontal distance in feet from the surface of the glazing to the outside edge of the overhang.
- *Overhang Ht "V".* The vertical distance (in feet) from the top of the glazing frame to the bottom edge of the overhang at the distance “H” from the glazing surface. See Figure R2-1.
- *Overhang Left Extension.* The distance in feet from the left edge of the glazing frame to the left edge of the overhang. "Left" and "right" are established from an exterior view of the window.
- *Overhang Right Extension.* The distance in feet from the right edge of the glazing frame to the right edge of the overhang.

2.2.10 Side Fins

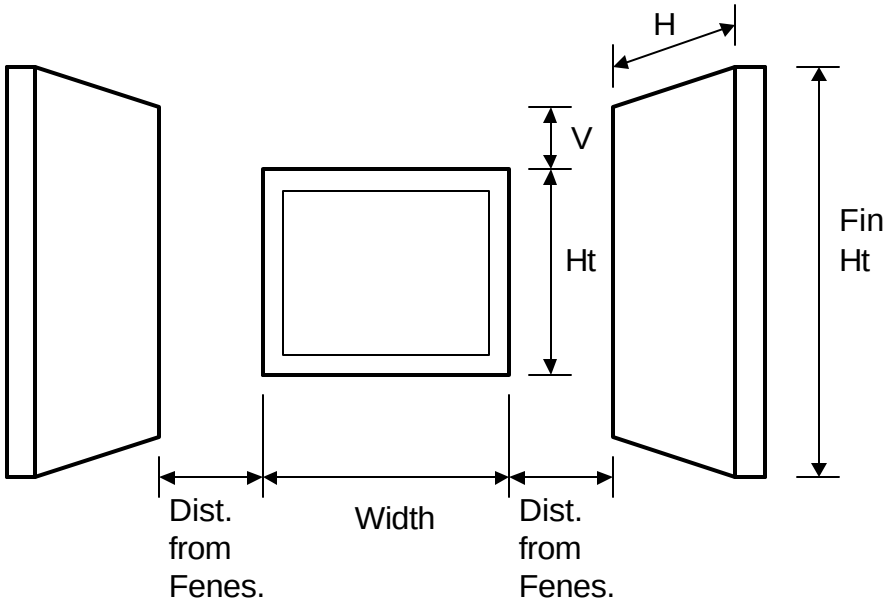

Figure R2-2 – Side Fin Dimensions

SIDE FINS

Fenestration			Left Fin				Right Fin			
#/Type/Orien	Wdth	Ht	Dist from fenes	Lngth "H"	Ht "V"	Fin Ht	Dist from fenes	Lngth "H"	Ht "V"	Fin Ht
3 Wdw Back(S)	4.0	5.0	6.0	2.0	6.0	8.0	6.0	2.0	6.0	8.0

- *Fenestration #/Type/Orien.* This shall correspond to an item in the fenestration surfaces list.
- *Fenestration Wdth.* The width of the rough-out opening for the fenestration (in feet) measured from the edge of the opening or frame on one side to the edge of the opening or frame on the other side.
- *Fenestration Ht.* The height of the rough-out opening for the fenestration (in feet) measured from the bottom of the opening or frame to the top of the opening or frame.
- *Left Fin Dist from fenes*. The distance in feet from the nearest glazing frame edge to the fin. "Left" and "right" are established from an exterior view of the window.
- *Left Fin Lngth "H".* The horizontal distance in feet from the surface of the glazing to the outside edge of the fin.
- *Left Fin Ht "V"*. The vertical distance (in feet) from the top of the glazing frame to the top edge of the fin.
- *Left Fin, Fin Ht.* The height of the fin, in feet.
- *Right Fin.* Similar to Left Fin items.

2.2.11 Inter-Zone Surfaces

This listing is used only for proposed designs modeled as multiple thermal zones which is considered an exceptional condition and shall also be listed in the *Special Features and Modeling Assumptions* listings for the CF-1R. The *Special Features and Modeling Assumptions* listing shall direct plan and field checkers to the listings for *Interzone Surfaces* and *Interzone Ventilation*. The *Interzone Surfaces* listing describes the characteristics of the surfaces that separate the zones.

For buildings that are modeled with more than two thermal zones, the inter-zone surfaces shall be grouped so that it is clear which zones are separated by the surfaces. The groupings shall be labeled "Between ZoneName1 and ZoneName2" or some similar convention. This information may also be provided through additional columns in the table.

INTER-ZONE SURFACES

Surface Type	Area (ft^2)	U-factor	Cavity Insul R-val	Sheath Insul R-valu	ACM Joint Appendix IV	Location/Comments
Between Living and Sunspc						
Wall	100	0.09	R-11	na	Wall-2	Insulated partition
Glass	30	1.10	SglGls	na		Sliding glass door
Between Sleeping and Sunspc						
Wall	220	0.09	R-11	R-4	Wall-2	Insulated partition
Glass	10	1.10	SglGls	na		Window
Between Living and Sleeping						
Wall	206	0.293	R-0	na	Wall-3	Gypsum partitions
Door	40	0.33	R-0	na		Hollow core doors

- *Surface Type.* The type of surface separating the zones. Possible types are window, wall, etc.
- *Area (ft^2).* The area of the surface in square feet that separates the zones.
- *U-val.* The U-factor of the surface.
- *Cavity Insul R-val.* The R-value of insulation installed in cavity of the framed construction assembly. This does not account for framing effects, drywall, air films, etc.
- *Sheath Insul R-val.* The total R-value of all insulation layers (layers R-2 or greater) not penetrated by framing. Excludes low R-value layers such as sheetrock, building paper, and air films.
- *ACM Joint Appendix IV Reference*. A reference to a selection from ACM Joint Appendix IV.
- *Location/Comments.* User provided information on the location of the inter-zone surface or other relevant information.

2.2.12 Inter-Zone Ventilation

This listing is used for proposed designs that are modeled as multiple building zones. The modeling of multiple building zones is considered an exceptional condition that shall be reported in the *Special Features* and *Modeling Assumptions* listings, which shall also refer to the information in this listing when this listing is generated by the ACM to echo user inputs for Inter-Zone Ventilation. If inter-zone ventilation is modeled, it shall be reported in this listing. It describes natural and/or mechanical ventilation systems that separate the zones.

For buildings that are modeled with more than two thermal zones, the inter-zone ventilation items shall be grouped so that it is clear which zones are linked by the items. The groupings shall be labeled "Between ZoneName1 and ZoneName2" or some similar convention. This information may also be provided through additional columns in the table.

INTER-ZONE VENTILATION

Vent Type	Inlet Area	Outlet Area	Height Diff.	Fan Watts	Fan Flow (cfm)	Location/ Comments
Between Living and Sunspc						
Natural	20	20	3	na	na	

- *Vent Type.* Possible types are natural and fan.
- *Inlet Area.* The area of the air inlet in square feet. This is used only when vent type is "natural".
- *Outlet Area.* The area of the air outlet in square feet. This is used only when vent type is "natural".
- *Height Diff.* The elevation difference between the inlet and the outlet in feet. This is used only when vent type is "natural". Default is two feet.
- *Fan Watts.* The fan power rating in watts. This is used only for sunspaces and only then when vent type is "fan". Fan energy may be reported as a separate line item or added to the TDV energy for heating.
- *Fan Flow (cfm).* The cubic feet per minute of air flow provided when the fan is operating. This is used only for sunspaces and then only when vent type is "fan".
- *Location/Comments*. User provided text describing where the item is located or other relevant information.

2.2.13 Infiltration/Ventilation

This listing is only produced when the applicant has used reduced infiltration measures (and mechanical ventilation when necessary) to improve the overall energy efficiency of the Proposed Design while maintaining adequate air quality. Reduced infiltration credit may be taken for duct sealing and installation of an air retarder without a blower door test. Otherwise, the use of reduced infiltration requires diagnostic blowerdoor testing by a installer and a certified HERS rater to verify the modeled reduced leakage area and to ensure minimum infiltration/ventilation rates are achieved. Relevant information regarding infiltration and ventilation shall be reported in the *Field Verification and Diagnostic Testing* listings on the CF-1R. The listings shall indicate that diagnostic blower door testing shall be performed as specified in ASTM E 779-03, *Standard Test Method for Determining Air Leakage Rate by Fan Pressurization*. This listings shall also report the target $CFM50_H$ required for the blower door test to achieve the modeled SLA and the minimum $CFM50_H$ (corresponding to an SLA of 1.5) allowed to avoid backdraft problems. This minimum allowed value is considered by the Commission to be “unusually tight” in the requirements of the California Mechanical Code.

When the target $CFM50_H$ of the *Proposed Design* is below the value corresponding to an SLA of 3.0, mechanical ventilation with a minimum capacity of 0.047 CFM per square foot of conditioned floor area is required. This requirement for mechanical ventilation and minimum capacity shall be reported in the *Field Verification and Diagnostic Testing* listings of the CF-1R. Also, the *Field Verification and Diagnostic Testing* listings shall state that when the measured $CFM50_H$ is less than the minimum allowed value, corrective action shall be taken to either intentionally increase the infiltration or provide for mechanical supply ventilation adequate to maintain the dwelling unit at a pressure greater than -5 pascals relative to the outside average air pressure with other continuous ventilation fans operating.

When mechanical ventilation is part of the Proposed Design the exhaust and supply fan wattages shall be reported in this listing and the *Field Verification and Diagnostic Testing* listings. Whenever mechanical ventilation is modeled by the user or required by modeling an SLA of 3.0 or less, the mechanical ventilation capacity selected by the user shall be greater than or equal to 0.047 cfm per square foot of conditioned floor area to be modeled by an approved ACM. If the user enters a volumetric capacity that is less than 0.047 cfm/ft^2, the ACM shall indicate an input error to the user and block compliance output.

When reduced infiltration or mechanical ventilation is modeled, the *Special Features and Modeling Assumptions* listings shall include a statement that the homeowner’s manual provided by the builder to the homeowner shall include instructions that describe how to use the operable windows or mechanical ventilation to provide for proper ventilation.

INFILTRATION/VENTILATION DETAILS *(Example Listing)*

Blower Door Leakage Target ($CFM50_H$/SLA)	Blower Door Leakage Minimum ($CFM50_H$/SLA)	Vent. Fan CFM (Supply/Exhaust)	Mechanical Vent Fans (Watts) [Supply/Exhaust]
1250/2.9	586/1.5	200/300	*50/75*

- *Blower Door Leakage Target ($CFM50_H$/SLA):* The measured blower door leakage in cfm at 50 pascals of pressurization and its equivalent Specific Leakage Area (SLA) value.
- *Blower Door Leakage Minimum ($CFM50_H$/SLA):* The limit for the blower door leakage test to avoid backdrafting, which corresponds to a Specific Leakage Area (SLA) of 1.5, considered to be "unusually tight" for California Mechanical Code compliance. The ACM shall report in the *Field Verification and Diagnostic Testing* listings that the Commission considers this minimum CFM and the corresponding SLA of 1.5 or less to be "unusually tight" per the Uniform Mechanical Code. In the sample listing given above a 1600 square foot house and the SLA lower limit of 1.5 is used to determine the *Blower Door Leakage Minimum* shown.
- *Vent. (Ventilation) Fans (CFM):[Supply/Exhaust]* The total volumetric capacity of supply fans and exhaust fans listed separately, separated by a slash (or reported in separate columns). The balanced portion of mechanical ventilation is the smaller of these two numbers while the unbalanced portion is the difference between these two numbers. These values are reported in cubic feet per minute.
- *Mechanical Vent. (Ventilation) Fans (Watts) [Supply/Exhaust]:* The total power consumption of the supply ventilation fans and the total power consumption of the exhaust ventilation fans in watts.

Use of an air retarding wrap shall be reported in the Special Features and Diagnostic Testing listings.

2.2.14 Slab Surfaces

This table shall be listed when the building has slab surfaces but does not qualify as a high mass design (see Thermal Mass in Chapters 3 and 4). If the building qualifies as a high mass design, this listing is omitted and the listing for high mass designs is included.

SLAB SURFACES

Mass Name	Area (ft^2)
Zone=Living	
Standard Slab	1600

- *Mass Name.* The name of the mass element.
- *Area (ft^2).* The area of the mass in square feet.

2.2.15 Thermal Mass for High Mass Design

This table can only appear if and when the Proposed Design qualifies as a high mass building (see Chapter 3). High mass buildings are considered to be an exceptional condition and shall be reported in the *Special Features and Modeling Assumptions* listings on the CF-1R. The table specified below provides detail about the thermal mass elements in qualifying high mass building. One row is provided in the table for each mass element.

Thermal mass elements may be located within a single zone, they may separate zones or they may be located on an exterior wall. Mass elements in each of these categories shall be grouped and labeled accordingly. Additional columns may be added to the table to provide this information.

THERMAL MASS FOR HIGH MASS DESIGN

Mass Name	Area (ft^2)	Thickness (inches)	Volumetric Heat Capacity (Btu/ft^3-°F)	Conductivity (Btu-in)/($hr-ft^2$-°F)	ACM Joint Appendix IV	Inside Surface R-value ($hr-ft^2$-°F)/Btu	Location/Comments
Zone=Living							
ExpSlb-L	273	3.5	28	.98	na	0	Exposed in living
CarSlb-L	419	3.5	28	.98	na	2	Carpeted in living
Zone=Sleep							
ExpSlb-S	273	3.5	28	.98	na	0	Exposed in sleeping
CarSlb-S	419	3.5	28	.98	na	2	Carpeted in sleeping
Zone=SunSpc							
SSSlb	450	3.5	28	.98	na	0	Sunspace slab
Between Sunspc and Living							
SSWall	100	8.0	28	.98	na	0	Masonry wall

- *Mass Name.* The name of the mass element. This name may be referenced from the optional solar gains targeting section of the fenestration surfaces table.
- *Area (ft^2).* The area of the mass in square feet.
- *Thickness.* The mass thickness in inches.
- *Heat Capacity.* The volumetric heat capacity of the mass material in Btu/°F-ft^3.
- *Conductivity.* The conductivity of the mass material in Btu-in/h-ft^2 -°F.
- *ACM Joint Appendix IV Reference.* A reference to a lookup from ACM Joint Appendix IV..
- *Inside Surface R-value.* The thermal resistance of any material (such as carpet or tapestry) that may exist on the inside surface of the thermal mass excluding air films. For instance, if a mass element is carpeted, a surface R-value of 2 is the fixed input. For mass elements that separate thermal zones, the surface R-value may be reported separately for each side of the mass.
- *Location/Comments.* User provided information on the location of the mass element or other relevant information.

2.2.16 HVAC Systems

Information is provided on the type of heating and cooling systems proposed for each zone of the building. Data in the table is organized to accommodate any type of heating or cooling system so some of the information is not applicable for all system types. When the information is not applicable, "na" is reported. Data in this table should be organized first by thermal zones and then by heating and cooling systems. Note that the thermostat type is reported under "Building Zone Information" described above.

For buildings that are modeled as multiple thermal zones, the items shall be grouped for each zone and indicated with a header "Zone = <ZoneName>". The zone name used in the header should be the same as the name used in the table titled "Building Zone Information"

HVAC SYSTEMS

Equipment Type	Minimum Equipment Efficiency (or Water Heating System Name)	Verified Refrigerant Charge	Verified Adequate Airflow	Verified Fan Watt Draw	Verified Cooling Capacity
Zone=Living					
Furnace	0.78 AFUE	N/A	N/A	N/A	N/A
AirCond-Split	10.0 SEER/9.3 EER	Yes	Yes	240	Yes
Zone=Sleep					
CombHydro	Upper Floors	N/A	N/A	N/A	N/A
AirCond-Split	10.0 SEER	No	No	No	No

- *Equipment Type*. The type of heating or cooling equipment. This is specified separate from the distribution type. Required heating equipment and cooling equipment entries are listed in Table R2-1 and Table R2-2. When the proposed house is not air conditioned, the entry should be NoCooling. If more than one type of equipment is specified, they may be listed on subsequent rows. If Gas Absorption equipment is specified, it shall be reported in the *Special Features and Modeling Assumptions* listings on the CF-1R forms printed by the ACM.
- *Minimum Equipment Efficiency.* The minimum equipment efficiency needed for compliance. The applicable efficiency units should also be reported, for instance AFUE for furnaces and boilers, HSPF for electric heating equipment, and SEER for heat pumps (cooling) and central air conditioners. In the case of combined hydronic heating, the name of the water heating system shall be identified. If the equipment type is Electric (other than heat pump), an HSPF of 3.413 should be entered, except for radiant systems which use a maximum HSPF of 3.55. EER indicates that the energy efficiency ratio at ARI test conditions has been specified and will be verified according to the procedure in ACM Appendix RI - Procedures for Verifying the Presence of a Thermostatic Expansion Valve or High Energy Efficiency Ratio Equipment, and shall also be reported in the *Field Verification and Diagnostic Testing* listings.
- *Verified Refrigerant Charge.* The choices are 'Yes' or 'No' where 'Yes' means that either refrigerant charge is verified or a TXV is installed and verified. Refrigerant charge credit is applicable to split system air conditioners and heat pumps only. The two equipment types that can comply by verifying refrigerant charge are SplitAirCond, and SplitHeatPump.
- *Verified Adequate Airflow.* Yes indicates that the air flow will be tested and verified according to the procedure in ACM Appendix RE - Forced Air System Fan Flow and Air Handler Fan Watt Draw and shall also be reported in the *Field Verification and Diagnostic Testing* listings. No indicates that the default air flow is used.
- *Verified Fan Energy*. A number such as 240 indicates the user specified air handler fan watt draw that will be tested and verified according to the procedure in ACM Appendix RE - Forced Air System Fan Flow and Air Handler Fan Watt Draw and shall also be reported in the *Field Verification and Diagnostic Testing* listings No indicates that the default fan watt draw is used.
- *Verified Maximum Cooling Capacity*. Yes indicates that the proposed design will have an air conditioner sized according to the ACM calculations in ACM Appendix RF – HVAC Sizing and this shall also be reported in the *Field Verification and Diagnostic Testing* listings. Systems may claim this credit only if they also have claimed credit for the combination of verified adequate airflow, sealed and tested new duct systems, and proper refrigerant charge (or alternatively a TXV). No indicates that no sizing credit is being taken.

Table R2-1 – HVAC Heating Equipment Descriptors

Recommended Descriptor	Heating Equipment Reference
CntrlFurnace	Gas- or oil-fired central furnaces, propane furnaces or heating equipment considered equivalent to a gas-fired central furnace, such as wood stoves that qualify for the wood heat exceptional method. Gas fan-type central furnaces have a minimum AFUE=78%. Distribution can be gravity flow or use any of the ducted systems. [Efficiency Metric: AFUE]
Heater	Non-central gas- or oil-fired space heaters, such as wall heaters floor heaters or unit heater. Equipment has varying efficiency requirements. Distribution is ductless and may be gravity flow or fan-forced.. Can refer to floor furnaces and wall heaters within the description field for CntrlFurnaces, [Efficiency Metric: AFE]
Boiler	Gas or oil boilers. Distribution systems can be Radiant, Baseboard or any of the ducted systems. Boiler may be specified for dedicated hydronic systems. Systems in which the boiler provides space heating and fires an indirect gas water heater (IndGas) may be listed as Boiler/CombHydro Boiler and shall be listed under “Equipment Type” in the HVAC Systems listing. [Efficiency Metric: AFUE]
SplitHeatPump	Heating side of central split system heat pump heating systems. Distribution system shall be one of the ducted systems. [Efficiency Metric: HSPF]
PkgHeatPump	Heating side of central packaged heat pump systems. Central packaged heat pumps are heat pumps in which the blower, coils and compressor are contained in a single package, powered by single phase electric current, air cooled, rated below 65,000 Btuh. Distribution system shall be one of the ducted systems. [Efficiency Metric: HSPF]
LrgPkgHeatPump	Heating side of large packaged units rated at or above 65,000 Btu/hr (heating mode). Distribution system shall be one of the ducted systems. These include water source and ground source heat pumps. [Efficiency Metric: COP]
RoomHeatPump	Heating side of non-central room air conditioning systems. These include small ductless split system heat pump units and packaged terminal (commonly called “through-the-wall”) units. Distribution system shall be DuctIndoor. [Efficiency Metric: COP]
Electric	All electric heating systems other than space conditioning heat pumps. Included are electric resistance heaters, electric boilers and storage water heat pumps (air-water) (StoHP). Distribution system can be Radiant, Baseboard or any of the ducted systems. [Efficiency Metric: HSPF]
CombHydro	Water heating system can be storage gas (StoGas, LgStoGas), storage electric (StoElec) or heat pump water heaters (StoHP). Distribution systems can be Radiant, Baseboard, or any of the ducted systems and can be used with any of the terminal units (FanCoil, RadiantFlr, Baseboard, and FanConv).

Table R2-2 – HVAC Cooling Equipment Descriptors

Recommended Descriptor	Cooling Equipment Reference
NoCooling	Entered when the proposed building is not air conditioned or when cooling is optional (to be installed at some future date). Both the Standard Design equivalent building and the proposed design use the same default system (refer to sections 3.6.2). [Efficiency Metric: SEER]
SplitAirCond	Split air conditioning systems. Distribution system shall be one of the ducted systems. [Efficiency Metric: SEER and EER]
PkgAirCond	Central packaged air conditioning systems less than 65,000 Btuh cooling capacity. Distribution system shall be one of the ducted systems. [Efficiency Metric: SEER and EER]
LrgPkgAirCond	Large packaged air conditioning systems rated at or above 65,000 Btu/hr (cooling capacity). Distribution system shall be one of the ducted systems. [Efficiency Metric: EER]
RoomAirCond	Non-central room air conditioning cooling systems. These include small ductless split-system air conditioning units and packaged terminal (commonly called through-the-wall) air conditioning units. Distribution system shall be DuctIndoor. [Efficiency Metric: EER]
SplitHeatPump	Cooling side of split heat pump systems. Distribution system shall be one of the ducted systems. [Efficiency Metric: SEER and EER<65,000 Btu/hr EER>65,000 Btu/hr]
PkgHeatPump	Cooling side of central single-packaged heat pump systems with a cooling capacity less than 65,000 Btuh. Distribution system shall be one of the ducted systems. [Efficiency Metric: SEER]
LrgPkgHeatPump	Cooling side of large packaged heat pump systems rated at or above 65,000 Btu/hr (cooling capacity). Distribution system shall be one of the ducted systems. [Efficiency Metric: EER]
GasCooling	Gas absorption cooling. Three descriptors, COP95, the rated COP for the gas portion, CAP95, the rated capacity, and PPC, the parasitic electric energy at rated conditions in Watts.
RoomHeatPump	Cooling side of non-central, room heat pump systems. These include small ductless split-system air conditioning units and packaged terminal (commonly called ”through-the-wall”) units. Distribution system shall be DuctIndoor. [Efficiency Metric: EER]
EvapDirect	Direct evaporative cooling systems. The SEER is set to 11.0. The default distribution system location is DuctAttic; evaporative cooler duct insulation requirements are the same as those for air conditioner ducts. [Efficiency Metric: SEER]
EvapIndirDirect	Indirect-direct evaporative cooling systems. The SEER is set to 13.0. The default distribution system location is DuctAttic; evaporative cooler duct insulation requirements are the same as those for air conditioner ducts. [Efficiency Metric: SEER]

Table R2-3 – HVAC Distribution Type and Location Descriptors

Recommended Descriptors	HVAC Distribution Type and Location Reference
Air Distribution Systems	Fan-powered, ducted distribution systems that can be used with most heating or cooling systems. When ducted systems are used with furnaces, boilers, or combined hydronic/water heating systems the electricity used by the fan shall be calculated using the methods described later in this manual. R-value shall be specified in "Duct R-value" column when a ducted system is specified
DuctsAttic	Ducts located overhead in the unconditioned attic space
DuctsCrawl	Ducts located underfloor in the unconditioned crawl space
DuctsCVC	Ducts located underfloor in a controlled ventilation crawl space
DuctsGarage	Ducts located in an unconditioned garage space.
DuctsBasemt	Ducts located in an unconditioned basement space
DuctsInEx12	Ducts located within the conditioned floor space except for less than 12 lineal feet of duct, typically an HVAC unit in the garage mounted on return box with all other ducts in conditioned space.
DuctsInAll	HVAC unit or systems with all HVAC ducts located within the conditioned floor space. Location of ducts in conditioned space eliminates conduction losses but does not change losses due to leakage. Leakage from either ducts that are not tested for leakage or from sealed ducts are modeled as leakage to outside the conditioned space.
DuctsNone	Air distribution systems without ducts such as ductless split system air conditioners and heat pumps, window air conditioners, through-the-wall heat pumps, etc.
DuctsOutdoor	Ducts located in exposed locations outdoors.
Ductless Systems	Ductless radiant or warm/cold air systems using fan-forced or natural air convection and hydronic systems relying upon circulation pumps and fan-forced or natural air convection, and
Furnaces	Heating equipment such as wall and floor furnaces
Radiant	Radiant electric panels or fanless systems used with a boiler, electric or heat pump water heater, or combined hydronic heating equipment.
Baseboard	Electric baseboards or hydronic baseboard finned-tube natural convection systems

2.2.17 Maximum Cooling Capacity

This listing is always provided, however, the column for maximum cooling capacity is completed only when compliance credit is specified for verified cooling capacity is specified in Section 2.2.16 HVAC Systems. Systems may claim this credit only if they also have claimed credit for the combination of verified adequate airflow, sealed and tested new duct systems, and proper refrigerant charge (or alternatively a TXV). The design loads are calculated in accordance with appendix RF-2005 using the 1.0% Summer Design Dry Bulb and 1.0% Summer Design Wet Bulb outdoor design temperature data from Joint Appendix ACM II and inside design temperatures from Standards Section 150(h). Heating system sizing is not required, but may be included at the ACM vendors option.

HVAC SIZING

Location: Modesto, Cooling design Temp = 99, Cooling Daily Range = 28

Equipment Type	Sensible Design Cooling Load Btu/hr)	Design Cooling Capacity at ARI Rated Conditions Design Equipment Capacity (Btu/hr)	Maximum Cooling Capacity for Verified Cooling Capacity ACM Credit (Btu/hr)
Zone=Living			
AirCond-Split	**19730**	**23470**	**N/A**
Zone=Sleeping Living			
AirCond-Split	9873	11270	N/A
Building Total	29603	34740	40740

- *Equipment Type.* The type of heating or cooling equipment.
- *Sizing Location.* Location for sizing calculation from list in the Joint Appendices ACM II.
- *Cooling Outside Design Temperature* (°F). As defined for the sizing location in the Joint Appendices ACM II.
- *Cooling Outside Daily Range* (°F). As defined for the sizing location in the Joint Appendices ACM II.
- *Inside Design Temperature* (°F). As required in Standards Section 150(h).
- *Sensible Design Cooling Load (Btu/hr*). Total sensible cooling load at design conditions including duct losses. Calculated in accordance with Appendix RF-2005.
- *Design Cooling Capacity at ARI Conditions (Btu/hr*). Rated capacity needed to meet the Sensible Design Cooling Load calculated in accordance with Appendix RF-2005.
- *Maximum Allowable Cooling Capacity for ACM Credit for the building.* Maximum total rated system cooling capacity that may be installed if claiming the sizing credit. For buildings with more than one system the sum fo the sizes of the equipment installed must be less than the total *Allowable Cooling Capacity for ACM Credit for the building*. Calculated in accordance with Appendix RF-2005.

2.2.18 Duct Systems

This listing shall be displayed any time ducts are included in the heating and/or cooling system sealing and testing is specified. As many rows as necessary may be used to describe each duct system.

DUCT SYSTEMS

Equipment Type	Distribution Type and Location	Duct R-value (h-ft²-°F/Btu)	Verified Duct Leakage
Furnace / SplitAirCond	DuctsAttic	4.2	Not Tested
Furnace / SplitAirCond	DuctsAttic	8	Tested New Ducts
Furnace / SplitAirCond	DuctsAttic	4.2	Tested Existing Ducts

- *Equipment Type.* The type of heating or cooling equipment. This is specified separate from the distribution type. Required heating equipment and cooling equipment entries are listed in Table R2-1 and Table R2-2. When the proposed house is not air conditioned, the entry should be NoCooling. If more than one type of equipment is specified, they may be listed on subsequent rows.
- *Duct R-value (hr-ft^2-°F/Btu)*. The nominal R-value of the duct insulation.

- *Distribution Type and Location*. The default distribution type and location is a ducted, central system with 100% of the ducts in the attic. If a duct design is specified with duct locations on the plans but without specific duct surface areas (sizes and lengths) specified, the *Special Features and Modeling Assumptions* listing shall specify the default duct locations. To use DuctsCrawl or DuctsBsmt, all supply registers shall be in the floor or within two feet of the floor and the *Special Features and Modeling Assumptions* listings shall indicate that all supply registers are in the floor or within two feet of the floor. These two cases do not require field verification. All other cases require field verification.
- *Verified Duct Leakage*. If verified (tested) duct leakage is specified by the user, the requirement for diagnostic testing shall be reported in the *Field Verification and Diagnostic Testing* listings on the CF-1R.

2.2.19 Supply Duct System Details

This listing shall be displayed any time credit for ducts in conditioned space, reduced duct surface area, and/or combinations of higher performance insulation (including ducts buried under the attic insulation) are specified. The portions of duct run located on the floor of the attic within 3.5 inches of the ceiling gypsum board and covered or partially covered with blown attic insulation of R-30 or greater in houses meeting the criteria for Insulation Installation Quality (ACM RH) may take credit for increased effective duct insulation. A full description of the requirements and criteria for supply duct system details is in Section 4.8. As many rows as necessary may be used to describe each duct run. These credits shall also be reported in the *Special Features and Modeling Assumptions* listings.

SUPPLY DUCT SYSTEM DETAILS

Description	Location	Duct Length (ft)	Duct Diameter (in.)	Duct Insulation R-value (h-ft²-°F/Btu)	Buried Duct	Attic Insulation R-value (h-ft²-°F/Btu)	Attic Insulation Type
Main 1	Attic	35	16	4.2	No	N/a	N/a
Branch 1	Crawlspace	15	12	4.2	No	N/a	N/a
Branch 2	Conditioned	10	12	4.2	No	N/a	N/a
Run 1	Attic	22	6	4.2	Yes	38	Fiberglass
Run 2	Attic	17	6	4.2	Yes	38	Cellulose
Run 3	Attic	12	6	4.2	Deep	38	Cellulose

Effective Supply System Duct R-value = 5.6

- *Description (text):* Description given to each length of supply duct.
- *Location* (prescribed descriptor): The location of the duct. Permissible types: Listed in Table R2-3.
- *Duct Length (ft).* The length of the duct in feet.
- *Duct Diameter (in.)* The diameter of the duct in inches.
- *Duct Insulation R-value (hr-ft^2-°F/Btu)*. The nominal R-value of the duct insulation.
- *Buried Duct (prescribed descriptor).* The choices are 'Yes', 'No' or 'Deep'. 'No' means that the ducts are not buried and no credit is being taken. 'Yes' means that this duct is located on the floor of the attic within 3.5 inches of the ceiling gypsum board and will be covered or partly covered by blown ceiling insulation. 'Deep' applies when duct segment is deeply buried in lowered areas of ceiling and has at least 3.5" of blown insulation above the top of the duct.
- *Attic Insulation R-value (hr-ft^2-°F/Btu)*. The nominal R-value of the attic insulation covering buried ducts
- *Attic Insulation Type (prescribed descriptor).* The choices are 'Fiberglass' for blown fiberglass or 'Cellulose' for blown cellulose.

2.2.20 Special Systems - Hydronic Distribution Systems and Terminals

This listing shall be completed for hydronic systems that have more than 10 feet of piping (plan view) located in unconditioned space. As many rows as necessary may be used to describe the piping system. Note that hydronic heating systems (combined or not) shall be reported in the *Special Features and Modeling Assumptions* listings. The entry for the *Special Features and Modeling Assumptions* listings shall indicate any additional listings that are reported for this feature so that the local enforcement agency can verify the additional information needed to check this special feature.

SPECIAL SYSTEMS - HYDRONIC DISTRIBUTION SYSTEMS AND TERMINALS

Distribution System Name	Terminal Type	Number (#)	Piping Run Length (ft)	Nominal Pipe Size (in)	Insulation Thickness (in)	Insulation R-value
HydFanCoil	FanCoil	1	15	1.5	1.5	6.0
	Baseboard	1	20	,75	1	4.0
	FanCoil	1	15	.5	1.5	4.0

- *System Name (text):* Description given to the hydronic system.
- *Terminal Type (prescribed descriptor):* The type of terminal equipment used in the system. Permissible types: Listed in Table R2-4.

Table R2-4 – Hydronic Terminal Descriptors

Descriptor	Hydronic Terminal Reference
FanCoil	Ducted fan coil used in central systems
Baseboard	Baseboard convector using natural convection
RadiantFlr	Radiant floor

- *Piping Run Length (ft).* The length (plan view) of distribution pipe located in unconditioned space, in feet, between the primary heating/cooling source and the point of distribution.
- Nominal *Pipe Size.* The nominal (as opposed to true) pipe diameter in inches.
- *Insulation Thickness (in).* The thickness of the insulation in inches. Enter "none" if the pipe is uninsulated.
- *Insulation R-value (hr-ft^2-°F/Btu)*. The installed R-value of the pipe insulation. Minimum pipe insulation for hydronic systems is as specified in Standards Section 150 (j).

2.2.21 Water Heating

Water Heating Systems

This set of listings includes information about water heating systems. A water heating system may serve more than one dwelling unit, or a single dwelling unit may have more than one water heating system. A water heating system may also have more than one water heater, but may have only one distribution system. Each water heating system in the building is defined in one or more rows in the following two tables. Data in these tables is associated with data in the Water Heater/Boiler Equipment Detail Table. When there are multiple water heater types in a system, the last two columns may be repeated as necessary.

When an ACM models a water heating system that does not have a single separate water heater serving each dwelling unit, it shall be reported in the *Special Features and Modeling Assumptions* listings of the CF-1R. The *Special Features and Modeling Assumptions* listing shall cross-reference the listing below whenever multiple water heaters serve one or more dwelling units or when a single water heater serves more than one dwelling unit. Information concerning auxiliary energy systems, the performance and features of instantaneous gas, large

storage gas and indirect gas water heaters, and combined hydronic equipment, if installed, shall also be included in the *Special Features and Modeling Assumptions listing* if energy credit is taken for such systems.

WATER HEATING SYSTEMS CREDIT (Multiple systems in single dwelling unit)

System Name	Distribution System in Unit(s)	Recirculation System Control	Water Heater Name	Number of WH in System
System 1	Recirc/Timer	n. a.	State100	1
System 2	Recirc/Timer	n. a.	State50	1
System 3	pOU	n. a.	Loch006	1

WATER HEATING SYSTEMS CREDIT (Systems serving multiple dwelling units)

System Name	Distribution System in Unit(s)	Recirculation System Control	Water Heater Name	Number of WH in System
System 1	Stnd	RTm/Tmp (Stnd)	State100	3
System 2	Stnd	RDmd	State50	4

Notes

- *System Name.* This is a user defined name for the water heating system that provides a link between the water heating systems table, the Water Heating Systems Credits table, and the Water Heater/Boiler Equipment Detail table.
- *Distribution System in Unit(s).* Several specific distribution systems are recognized for distributing water within each dwelling unit. The distribution system listed in this column should be selected from Table R2-5.
- *Recirculation System Control.* This is only used for systems that serve multiple dwelling units. Enter a type of control from Table R2-6.
- *Water Heater Name (text).* This is a user defined name that provides a link between the *Water Heater Systems Credit* table and the *Water Heater/Boiler Equipment Detail* table. This table may be repeated if different types of water heaters are used in the same system.
- *Number of WH in System.* The number of identical water heaters of this type in the system.

Table R2-5 – Water Heating Distribution System (Within Dwelling Units) Descriptors

Distribution System Measure	Code	Description
Pipe Insulation (kitchen lines = 3/4 inches) – Standard Case	STD	Standard (non-recirculating) potable water heating system with tank storage remote from points of consumptive use. The portions of the pipe run from the water heater to the kitchen fixtures that are equal to or greater than 3/4 inch in diameter are insulated, as required by Section 151 (f) 8 D.
Pipe Insulation (all lines)	PIA	All pipes from the water heater to the fixtures are insulated, not just the ones equal to or greater than 3/4 inches to the kitchen, which is required by Section 151 (f) 8 D.
Standard pipes with no insulation	SNI	Standard water heating system with no insulation on pipes equal to or greater than 3/4 inches in diameter to the kitchen.
Point of Use	POU	Point-of-use potable water heating system, within 8' of fixtures
Parallel Piping	PP	A system of individual pipe runs from a manifold at the water heater to each fixture. This is also sometimes called homerun piping.
Recirculation (no control)	RNC	Recirculation system, with no control. The pump runs continuously.
Recirculation + timer control	RTm	Recirculation system, with timer control. The pump operates on a timeclock.
Recirculation + temperature control	RTmp	Recirculation system, with the pump controlled to maintain a minimum temperature in the circulation system.
Recirculation + timer/temperature	RTmTmp	Recirculation system, with combination timer control and temperature control.
Recirculation + demand control	RDmd	Recirculation system, with demand control.

Table R2-6 – Control Systems for Multi-Unit Distribution Systems

Type of Control	Code	Description
Uncontrolled Recirculation	NoCtrl	Circulation pump runs continuously.
Timer Control	STD	Recirculation system, with timer control. The pump operates on a timeclock.

Table R2-7 – Water Heater Types

Recommended Descriptor	Water Heater Reference
StoGas	Gas, propane, or oil-fired storage tank ≥ 2 gal, input ≤ 75,000 Btu/hr
LgStoGas	Gas, propane, or oil-fired storage tank, input > 75,000 Btu/hr
StoElec	electric-resistance-heated storage tank ≥ 2 gal
InstGas	instantaneous gas-fired, storage < 2 gal
InstElec	instantaneous electric-resistance-heated, storage < 2 gal
StoHP	electric heat pump with storage tank
IndGas	storage tank indirectly heated by gas- or oil-fired source
Boiler	boiler dedicated solely to hydronic space heating

Table R2-8 – Pipe Conditions for Systems Serving Multiple Dwelling Units

System Name	Length of pipes inside the space	Insulation of pipe inside the space	Length of pipes in ambient air	Insulation of pipes in ambient air	Length of pipes underground	Insulation of pipes underground
System 1	88	Standard	32	Extra	0	N/a
System 2	96	Standard	16	Standard	0	N/a

Water Heater/Boiler Equipment Detail

This listing provides information about the energy characteristics of the water heaters or boilers used to provide either domestic hot water or space heating through a combined hydronic (*CombHydro*) system. This table may be used for both NAECA and for non-NAECA water heaters (as specified by the Appliance Efficiency Regulations). This listing describes the equipment that serves the water heating system or systems. The information in the table will not be applicable to every water heater type. When the information is not applicable, "na" may be reported.

WATER HEATER/BOILER EQUIPMENT DETAIL

Water Heater Name	Type	Efficiency	Efficiency Units	Tank Size (gal)	Rated Input (kBtuh)	Combined Hydronic Pump (watts)	Standby Loss (fraction)	Tank Total R-value (hr-ft^2-°F/Btu)	Pilot Light (Btu/h)
CombHydState100	Boiler	0.78	AFUE	40	60.00		na	na	na
BigRmWH	LgStoGas	0.79	RE	50	75.00		0.04	15.30	na
Loch006	StoGas	0.78	EF	30	na.		na.	Na.	na.
State100 Hydro	StoGas	0.79	EF	30	40	40	na.	Na.	na.
State50	StoGas	0.80	EF	40	na.		na.	Na.	na.

- *Water Heater Name (text):* Name of water heater specified in the Water Heating Systems listing. In the case of a hydronic system heater, the name shall be unique in order to distinguish it from other water heaters.
- *Water Heater Type (recommended descriptor).* The water heater type will be one of the following choices from Table R2-7. The large storage gas water heaters are larger than the 75,000 Btu/h maximum input rated by the National Appliance Energy Conservation Act (NAECA). Indirect gas water heaters are essentially a boiler with a separate storage tank. Additional data required for large storage gas and indirect gas types is entered later in the Water Heater/Boiler Equipment Detail table. "Gas" is used for propane as well as natural gas. If oil water heaters are used, the "gas" choices may be selected.

- *Efficiency.* The efficiency of the water heater.
- *Efficiency Units.* Enter the units used for efficiency. For NAECA water heaters the energy factor (EF) will be entered. Thermal efficiency is the performance measure for instantaneous gas water heaters (*InstGas*), large storage gas/oil water heaters (*LgStoGas*) and indirect gas/oil water heaters (*IndGas*). It is also required for storage gas/oil water heaters (*StoGas*) used in combined hydronic systems (*CombHydro*). The value is taken from the Commission's appliance databases or from Commission-approved trade association directories. If the value is omitted for NAECA regulated water heaters, then the default value will be assumed. When boilers are used to fire an indirect gas/oil water heater (*IndGas*), the value of the AFUE or Thermal Efficiency (see below) is used for the recovery efficiency.
- *Tank Size for Direct Fired Tanks(gal).* The storage tank capacity in gallons. This input is applicable to all storage type water heaters. For NAECA covered water heaters, the input is optional.
- *Tank Size for Indirect Fired Tanks (gal).* The indirect fired storage tank capacity in gallons. This input is applicable to all hot water storage tanks that do not have an integral heating element or burner.
- *Combined Hydronic Pump (watts).* This is needed only for electric combined hydronic systems. It is not needed for storage gas or heat pump combined hydronic systems.
- *Rated Input (kBtu/hr for gas and kW for electric):* The energy input rating from the above directories or from the manufacturer's literature. Entries are required for large storage gas/oil water heaters *(LgStoGas)*, indirect gas/oil water heaters (*IndGas*), and when storage gas water heaters (*StoGas/LgStoGas*) or heat pump water heaters (*StoHP*) are used in combined hydronic space heating systems (*CombHydro*).
- *Standby Loss (fraction):* The fractional storage tank energy loss per hour during non-recovery periods (standby) taken from the Commission's database cited above. Applicable only to large storage gas water heaters (*LgStoGas*).
- *Tank R-value (hr-ft^2-ºF/Btu):* The total thermal resistance of the internally-insulated tank and any external insulation wrap. Applicable to large storage gas/oil (*LgStoGas*) and indirect gas/oil (*IndGas*) water heaters only.
- *Pilot light (Btu/hr)*: The pilot light energy consumption rating from the Commission's database. Applicable only to instantaneous gas (*InstGas*) and indirect gas/oil (*IndGas*) water heaters.

Table R2-9 summarizes the applicability of the inputs for the water heater types recognized by the calculation method.

Table R2-9 – Water Heater Input Summary

Input Item	NAECA Storage Gas	NAECA Storage Electric	NAECA Heat Pump	Instant. Gas	Instant. Electric	Large Storage Gas	Indirect Gas
Energy Factor	Yes	Yes	Yes	Yes	Yes		
Pilot Input, Btu				Yes		Yes	Yes
Efficiency, %				Yes		Yes	Yes
Standby Loss, %						Yes	
Tank Volume, gal.	Yes	Yes	Yes			Yes	Yes
Tank Insulation, R						Yes	Yes
Ext. Insulation, R						Yes	Yes
If Combined Hydronic System:							
Rated Input, kBtuh	Yes					Yes	Yes
Rated Input, kW		Yes	Yes				
Recovery Eff, %	Yes		Yes			Yes	Yes
Pump Input, Watts		Yes				Yes	Yes

Special Water Heating System Credits

This section includes information about water heating auxiliary energy credits, if used. These features are optional capabilities for ACMs and their use for performance compliance requires listing in the *Special Features and Modeling Assumptions* listings of the CF-1R. The *Special Features and Modeling Assumptions* listing shall cross-reference the applicable optional water heating capabilities modeled by the ACM.

WATER HEATING SYSTEMS MISC *(Example Listing)*

System Name	Solar Savings Fraction or SEF	SRCC Certification Number	Wood Stove Boiler?	Wood Stove Boiler Pump?	Combined Hydronic Pump Power (Watts)
Hydronic	0.00	*None*	*Yes*	*Yes*	60.00
DHW	0.66	*0002-1999-223*	*No*	*No*	

- *System Name.* This is a name corresponding to a system name defined in the Water Heating Systems table.
- *Solar Savings Fraction (SF) or Solar Energy Factor (SEF)*. If the water heating system has a solar system to provide part of the water heating, the SF or SEF is entered in this column. The SF shall be determined using the procedures defined with the optional modeling capability in Chapter 6.
- *SRCC Certification Number. Enter the SRCC certification number for the solar system (OG-300 rated) or the collectors (OG-100 rated). This number is issued by the SRCC when a product is certified.*
- *Wood Stove Boiler (Y/N).* This is a yes/no response on whether or not the system has a wood stove boiler. A credit may be taken for either solar systems or for a wood stove boiler, but not both.
- *Wood Stove Boiler Pump (Y/N).* This is a yes/no response to indicate whether the wood stove boiler has a recirculation pump.
- *Combined Hydronic Pump (Watts):* Required only for electric combined hydronic *(Elec/*, *StoElec/ and InstElec/CombHydro*) systems. Not required for storage gas/oil or heat pump combined hydronic systems (*StoGas/, LgStoGas/, and StoHP/CombHydro*).

2.2.22 Special Features and Modeling Assumptions

This listing shall **stand out and command the attention** of anyone reviewing this form to emphasize the importance of verifying these Special Features and the aspects of these features that were modeled to achieve compliance or the energy use results reported. This listing in the Certificate of Compliance shall include any special features of the building that affect the building's compliance with the standards. For example, water heating features, or auxiliary credits shall be listed under "*Special Features and Modeling Assumptions*" as well as being listed under a special listing of their own. The use of certain non-default values shall also be included in this list. These special default values are indicated in the subsequent text.

This is a free format section for the CF-1R report to note any special features about the building that are needed to verify compliance.

SPECIAL FEATURES AND MODELING ASSUMPTIONS: (*Example Listing)*	Plan Field	
This house has Zonal control with multiple zones, interzone surfaces, and interzone ventilation.		
This building uses metal-framed walls that shall meet mandatory insulation requirements. In many cases sheathing insulation is used in addition to cavity insulation.		
This house uses a non-NAECA large storage gas water heater. Check the SPECIAL WATER HEATER/BOILER DETAILS listing for specifications.		
This house has an attached sunspace with interzone surfaces, custom solar heat gain distribution and sunspace thermal mass elements.		
This house is modeled with reduced infiltration and/or mechanical ventilation. Consequently the homeowner's manual provided by the builder to the homeowner shall include operating instructions for the homeowner on how to use operable windows and/or mechanical ventilation to achieve adequate ventilation.		

2.2.23 Field Verification and Diagnostic Testing

This listing shall **stand out and command the attention** of anyone reviewing this form to emphasize the importance of Field Verification and Diagnostic Testing of these features and the aspects of these features that were modeled to achieve compliance.

Specific features that require diagnostic testing to assure proper installation require field testing and verification by a certified home energy rater (HERS rater) under the supervision of a CEC- approved HERS provider, and shall be listed in this section.

All items in the *Field Verification and Diagnostic Testing* listings shall also report that the installer and HERS rater shall both provide the appropriate CF-6R and CF-4R documentation, respectively, for proper installation, testing, and test results for the features that require verification by a HERS rater. The installer shall document and sign the CF-6R to verify compliance with design and installation specifications. The HERS rater shall document and sign the CF-4R to confirm the use of proper testing procedures and protocol, to report test results, and to report field verification of installation consistent with the design specifications needed to achieve these special compliance efficiency credits.

The ACM shall ask the user if there are vented combustion appliances inside the conditioned space that draw air for combustion from the conditioned space prior to accepting any entry for reduced infiltration or mechanical ventilation. Cooking appliances, refrigerators and domestic clothes dryers are excluded from this requirement. If appliances other than cooking appliances, refrigerators and domestic clothes dryers are present and use conditioned air for combustion, the ACM shall instruct the user that reduced infiltration shall not be modeled when these devices are part of the Proposed Design and block data entries and ACM modeling of reduced infiltration and mechanical ventilation. When the user indicates that such devices are present or when the user models reduced infiltration or mechanical ventilation, the ACM shall report in the *Special Features and Modeling Assumptions* listings that reduced infiltration and/or mechanical ventilation are prohibited from being modeled when vented combustion appliances, not excluded above, are inside conditioned space.

When a *Proposed Design* is modeled with a reduced target infiltration ($CFM50_H$) that corresponds to an SLA less than 3.0, mechanical ventilation is required and shall be reported in the *Field Verification and Diagnostic Testing* listings.

FIELD VERIFICATION AND DIAGNOSTIC TESTING

This house is using reduced duct leakage to comply and shall have diagnostic site testing of duct leakage performed by a certified HERS rater under the supervision of a CEC-approved HERS provider. The results of the diagnostic testing shall be reported on a CF-6R form and list the target and measured CFM duct leakage at 25 pascals.		
This house has tight construction with reduced infiltration and a target blower door test range between 586 and 1250 CFM at 50 pascals. The blower door test shall be performed using the ASTM *Standard Test Method for Determining Air Leakage Rate by Fan Pressurization*, ASTM E 779-03.		
This house is using an HVAC system with all ducts and the air handler located within the conditioned space. This results in a higher distribution efficiency rating due to elimination of conduction losses (losses due to leakage are not changed) and shall be visually confirmed by a certified HERS rater under the supervision of a CEC-approved HERS provider. This verification shall be reported on a CF-6R form.		
WARNING: If this house tests below 586 CFM at 50 pascals, the house shall either be provided with a ventilation opening that will increase the tested infiltration to at least 586 CFM at 50 pascals (SLA = 1.5) OR mechanical supply ventilation shall be provided that can maintain the house at a pressure of at least -5 pascals relative the outside average air pressure while other continuous ventilation fans are operating. Note also that the Commission considers an SLA≤1.5 to be "unusually tight" per the California Mechanical Code.		
WARNING - Houses modeled with reduced infiltration are prohibited from having vented combustion appliances other than cooking appliances, refrigerators and domestic clothes dryers that use indoor air for combustion inside conditioned space.		

2.2.24 Compliance Statement and Signatures

Signature requirements and other details on the compliance statement are included in Section 10-103(a)1 of the Administrative Regulations (Title 24, Part 1).

COMPLIANCE STATEMENT

This certificate of compliance lists the building features and performance specifications needed to comply with the Energy Standards in Title 24, Parts 1 and 6, of the California Code of Regulations, and the Administrative regulations to implement them. This certificate has been signed by the individual with overall design responsibility.

Designer or Owner (per Business & Professions Code)		Documentation Author	
Name	_____	Name	_____
Title/Firm	_____	Title/Firm	_____
Address	_____	Address	_____
City & Zip Code	_____	City & Zip Code	_____
Telephone	_____	Telephone	_____
License Number	_____	Signature/Date	_____
Signature/Date	_____		

Enforcement Agency	
Name	_____
Title	_____
Agency	_____
City	_____
Telephone	_____
Signature/Date	_____